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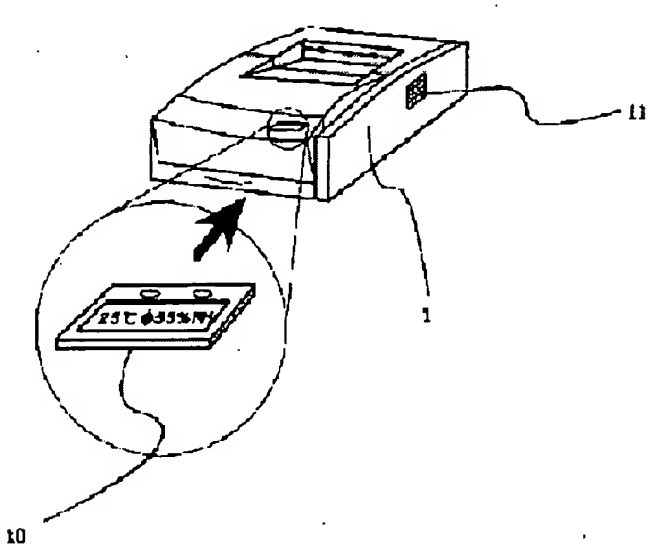
(54) **TITLE OF THE INVENTION:** Image forming device

(57) **ABSTRACT**

PROBLEM TO BE SOLVED: To provide an image forming device offering a capability for the drive control according to the environment in which it is used, a simplified structure and excellent reliability.

SOLUTION: Because the device has a structure wherein a temperature-humidity sensor 10 can be attached to the outer casing of the printer main body through one-touch operation, the printer main body changes control settings configured on it by having the temperature-humidity sensor 10 transmit to it control data, which are based the temperature and humidity.



SCOPE OF CLAIMS FOR PATENT

What is claimed is:

1: An image forming device comprising:
means for forming an image on a sheet, thereafter referred to as the "image forming means";
an adjustable mount for attaching an environmental sensor to the device main body as needed; and
wherein a prescribed drive control is changed on the basis of environmental information transmitted by the environmental sensor attached to the mount.

2: An image forming device according to claim 1, wherein the environmental sensor sends information based on the temperature and humidity to the device main body.

3: An image forming device according to either claim 1 or 2, wherein:
the image forming means, having a laser scanner unit for applying laser light corresponding to image information, is driven by a laser scanner motor and controlled to change the value limit of electric current sent to the laser scanner motor on the basis of environmental information transmitted by the environmental sensor.

4: An image forming device according to claim 1, 2 or 3, comprising a cooling device for cooling the temperature inside the image forming device, wherein the cooling device is controlled to turn on or off on the basis of environmental information transmitted by the environmental sensor.

5: An image forming device according to claim 1, 2, 3 or 4, comprising:
a fixing device for fixing, by applying heat and pressure, an unfixed image formed on a sheet by the image forming means,
wherein the heating temperature of the fixing device is controlled to change on the basis of environmental information sent by the environmental sensor.

6: An image forming device according to claim 1, 2, 3, 4 or 5, wherein:
the image forming means has a photoreceptor for forming a latent image on its surface upon being illuminated by laser light corresponding to image information, means for developing the latent image formed on the photoreceptor, thereafter referred to as the "developing means", and means for transferring onto a sheet the developed image, thereafter referred to as the "transfer means"; and
the transfer bias of the transfer means is controlled to change on the basis of environmental information sent by the environmental sensor.

7: An image forming device according to claim 1, 2, 3, 4, 5 or 6, wherein:
the image forming means has a photoreceptor for forming on its surface a latent image upon the application of laser light on the basis of image information, developing means for developing the latent image formed on the photoreceptor and transfer means for transferring the developed image onto a sheet; and
developing bias for the developing means is controlled to change on the basis of environmental

information sent by the environmental sensor.

8: An image forming device according to any one of claims 1 to 7, wherein multiple kinds of options are possible for control details when control is to perform a change on the basis of environmental information sent by the environmental sensor.

9: An image forming device according to claim 8, wherein an option is provided for selecting either a mode in which normal electric power is supplied to a designated drive part or a mode in which electric power below normal level is supplied.

10: An image forming device according to any one of claims 1 to 9, wherein the mount for the environmental sensor is provided with a socket matching the shape of the environmental sensor and a locking mechanism to allow for the environmental sensor to be locked in place or released as needed.

DETAILED DESCRIPTION OF THE INVENTION

[0001]
Technical Field of the Invention

The present invention relates to an image forming device such as a copying machine, a printer, a facsimile device and the like, having a function for forming an image on a sheet.

[0002]
Description of the Related Art

The conventional image forming devices of this type include copying machines, printers or facsimile devices.

[0003] Copying machines are generally equipped with a function for reading manuscripts and other images and form an image on a sheet on the basis of image information read in. In recent years, some copiers have been equipped with a communication facility and other functions so as to provide them with a capability for inputting image information sent in from outside.

[0004] Moreover, printers are generally designed to form images on a sheet on the basis of image information sent from external devices such as a computer, while facsimile devices are generally equipped with a function for reading in manuscripts and other images as well as with a communication facility, allowing them to send the read-in images to outside and to form an image on a sheet on the basis of information sent in from outside.

[0005] With these kinds of image forming devices, specifications were established for each component in order to ensure such things as the image quality and the life expectancy of the device for all environments under which the devices might be used.

[0006]
Problems to be Solved by the Invention

However, because specifications for the conventional devices were established under the assumption that these devices would be used in all kinds of environments as mentioned above, their cost has been higher than necessary.

[0007] In actuality, however, a guaranty for satisfactory quality for all environments was not normally needed. Therefore, it was sufficient if the quality, etc. could be guaranteed for the environment under which the device was used.

[0008] The present invention was the outcome of attempts to solve the above problems posed by the conventional devices, and its purpose is to provide an image forming device offering the ability to control the drive according to the environment under which it is used and having a simplified structure and excellent reliability.

[0009]
Means for Solving the Problems

In order to achieve the above goals, the image forming device of the present invention having image forming means for forming an image on a sheet was fitted with a mount for attaching an environmental sensor to the device main body as needed, thereby allowing the prescribed drive to be controlled to change on the basis of environmental information sent by the environmental sensor attached to the mount.

[0010] Consequently, the environmental sensor needs to be attached only when it is necessary to change the control configured in the image forming device. Moreover, the device can now be operated while using minimum electrical power.

[0011] It is desirable that the environmental sensor send information based on the temperature and humidity.

[0012] It is desirable that the image forming means be driven by a laser scanner motor, have a laser scanner unit for applying laser light on the basis of image information and be controlled by changing the value limit of electric current sent to the laser scanner motor.

[0013] It is desirable that a cooling device be provided for cooling the temperature inside the image forming device and that the cooling device be controlled to be turned on or off on the basis of environmental information sent by the environmental sensor.

[0014] It is desirable that a fixing device be provided for fixing, by applying heat and pressure, the unfixed images formed on a sheet by the image forming means and that the heating temperature of the fixing device be controlled to change on the basis of environmental information sent by the environmental sensor.

[0015] It is desirable that the image forming means comprise a photoreceptor, on the surface of which a latent image is formed upon exposure to laser light corresponding to image information, means for developing the latent image formed on the photoreceptor, and means for transferring the developed image onto a sheet and that the transfer bias for the transfer means be controlled to change on the basis of environmental information sent by the environmental sensor.

[0016] It is desirable that the image forming means comprise a photoreceptor, on the surface of which a latent image is formed upon exposure to laser light corresponding to image information, means for developing the latent image formed on the photoreceptor, and means for transferring the developed image onto a sheet and that the development bias for the developing means be controlled to change on the basis of environmental information sent by the environmental sensor.

[0017] It is desirable that multiple kinds of options be available for control details when control is executing a change on the basis of environmental information sent by the environmental sensor.

[0018] It is desirable that an option be available as to the control details either for a mode in which normal power is supplied to the prescribed drive part or a mode in which subnormal power is supplied.

[0019] It is desirable that the mount for the environmental sensor be provided with a socket that matches the shape of the environmental sensor and with a locking mechanism for locking in or releasing the environmental sensor as required.

[0020]
Description of the Preferred Embodiments

Embodiments of the present invention will now be described in detail using examples with reference to diagrams. However, the size, material, shape or relative configuration, and the like of the constituent elements mentioned in these embodiments shall not be construed as being restrictive to the scope of the present invention, unless they are specified in particular.

[0021] (First Embodiment)

An image forming device according to a first embodiment of the present invention will be described with reference to diagrams FIG. 1 to FIG. 4.

[0022] Incidentally, the present embodiment will be described using a laser printer as an example of the image forming device.

[0023] A sectional view of a schematic construction of an image forming device according to the embodiment of the present invention is shown in FIG. 1, while a perspective view of a schematic construction of an image forming device according to the embodiment of the present invention is shown in FIG. 2. An illustration of a mount for an environmental sensor (temperature-humidity sensor) is shown in FIG. 3, and FIG. 4 is a flowchart for the control of an image forming device

according to the first embodiment of the present invention.

[0024] In the diagrams, 1 is an outer casing of the main body of a laser printer, while 2 is paper used as the sheet, which is fed when a paper feeder roller 3 starts to rotate.

[0025] A carrier roller 4 sends the paper towards a toner cartridge 6.

[0026] A laser scanner unit 5, which has image forming means, scans laser light corresponding to print data.

[0027] A transfer device 7, serving as transfer means, transfers onto the paper a toner image formed on a photoreceptor drum provided in the toner cartridge 6.

[0028] Incidentally, the toner cartridge 6 forms an image using a publicly known image forming process and is fitted with such components as the photoreceptor drum, which forms a latent image on its surface upon exposure to laser light from laser scanning unit 5, and developing means for developing this latent image (toner image formation).

[0029]
A thermal fixing heater 8 and a pressure roller 9 constitute a fixing device, which fixes the unfixed toner image on the paper by applying heat and pressure.

[0030]
A temperature-humidity sensor 10 serves as the environmental sensor, which is a special feature of the embodiment of the present invention. As indicated by FIG.2, it is attached to the main body of the printer by one-touch operation.

[0031]
Moreover, the temperature-humidity sensor 10 is attached at a location where it is not readily affected by a rise in the temperature of the printer main body or by the heat of the paper being used.

[0032]
There are no special restrictions as to the mechanism by which the temperature-humidity sensor 10 is attached to the outer casing of the printer, so long as it can be attached or detached through one-touch operation.

[0033]
For instance, as illustrated in FIG.3, if the temperature-humidity sensor 10 has a card shape, a socket that matches the shape is provided in the printer main body so as to allow the sensor to be mounted into or dismounted out of the socket though one-touch operation.

[0034]
Moreover, the temperature-humidity sensor 10 can also be connected electrically by fitting together connectors, one of which is attached to the side of the sensor and another on the side of the printer main body.

[0035]
Furthermore, in this case, a locking mechanism for locking in or releasing the temperature-humidity sensor 10 while it is set in the socket can also be installed, and either of the connectors can also be made to serve as the locking mechanism.

[0036]
It is also possible to use a publicly known locking mechanism for the locking mechanism.

[0037]
Moreover, it would also be most suitable if a cover could be put in the socket when the temperature-humidity sensor 10 is not needed and removed when attaching the sensor (see FIG. 3).

[0038]
The temperature-humidity sensor 10 sends control data based on the temperature and humidity to the printer main body as environmental information.

[0039]
A cooling fan 11 serves as the cooling device for preventing the heating of the main body of the image forming device.

[0040]
When the temperature-humidity sensor 10 is attached to the main body of the device according to the structure given above, control data based on the temperature and humidity of the temperature-humidity sensor 10 are sent to the printer main body, which changes the control configured in it, as illustrated in FIG. 4.

[0041]
Firstly, data on temperature, humidity and time are inputted into the printer main body by the temperature-humidity sensor.

[0042]
In instances where temperature data show that the temperature has remained at a°C or less for a period of c hours or more, the value limit for the current sent to the laser scanner motor is reduced to the stipulated value because there is no need for a current supply that is more than at a fixed

level.

[0043]
Furthermore, if printing is not to be performed on more than *d* sheets in succession, this does not normally cause the temperature inside the device to rise, thus eliminating the need for cooling. Therefore, the cooling fan 11 is turned off.

[0044]
In instances where the temperature data remain at *a*°C or less and the humidity data at *b*% RH or less continuously for a period of *c* hours or more, then the power supply of more than a fixed level is not required, so the value limit for the power supply of the thermal fixing apparatus is reduced by the stipulated value.

[0045]
Furthermore, because there is no need for the heating temperature of more than a fixed level, the control temperature for the thermal fixing apparatus is reduced by the stipulated value.

[0046]
When the above conditions are not met, operation proceeds with the initial values set in the printer main body.

[0047]
Moreover, the initially set values of the printer are configured with sufficient allowances to give satisfactory results as to printing quality, performance and life expectancy under all environments in which the printer might be required to operate (there are stipulated values for the operating environment).

[0048]
As shown above, when the printer is operated with the initially set values, excessive power supply and the like will be used, because it means that the printer is operated under the control settings that can satisfy all environments. However, the installation of the temperature-humidity sensor 10 makes it possible to conserve energy by executing control according to the environment in which the printer is being operated. This also suppresses the consumption of toner by the toner cartridge.

[0049]
Moreover, although the structure of the above printer is such that the cooling fan is turned on only while printing is in progress, the cooling fan can be turned on in a similar manner even with a printer the structure of which is such that the cooling fan is turned on while it is at standby.

[0050] (Second Embodiment)
A second embodiment of the present invention is shown in FIG. 5.

[0051]
Incidentally, because the structure, etc. of the image forming device are the same as those shown in FIGS. 1 and 2 described in the first embodiment, explanation thereof will be omitted.

[0052]
Changing the control in response to a change in environment by attaching the temperature-humidity sensor 10 will be explained hereafter with reference to FIG. 5.

[0053]
FIG. 5 is a table showing variations in changes to the control of an image forming device according to the second embodiment of the present invention.

[0054]
This table summarizes how the environment in which the printer is placed dictates the change made to the control of the printer, within a range from an environment of high temperature and high humidity to that of low temperature and low humidity.

[0055]
Firstly, when the printer is placed in an environment of high temperature and high humidity for the stipulated number of hours or more, each control is changed in the following manner from the stipulated value provided for the environment of normal temperature and normal humidity.

[0056]
Transfer bias is reduced to the lower limit because there is no need to raise it higher than a fixed level due to increased transfer efficiency.

[0057]
Developing bias is reduced to below the stipulated value because print density increases under the conditions of high temperature and high humidity.

[0058]
Primary charge bias is also reduced because this relates to print quality.

[0059]
Power to the thermal fixing apparatus is reduced because there is no need for more than a fixed level.

[0060]
Incidentally, although this is not shown in the table, the control temperature for the thermal fixing apparatus is also reduced because more than a fixed level is no longer needed.

[0061]
However, because rasing the temperature of the thermal fixing apparatus improves the fixing ability when humidity is high, the control value is determined by also taking into consideration information regarding humidity.

[0062]
Likewise, the value limit for the electric current of the laser scanner motor is also reduced.

[0063]
Moreover, when the printer is left in the environment of low temperature and low humidity for longer than the stipulated number of hours, the controls are changed in the direction opposite to those in the case of the high-temperature and high-humidity environment, as shown in the table.

[0064]
Furthermore, in the table illustrated in the diagram, changes were explained by dividing the environment into three categories–high temperature and high humidity, normal temperature and normal humidity, and low temperature and low humidity–for situations in which each control value is changed either to the upper limit or the lower limit for the environment of high temperature and high humidity or that of low temperature and low humidity. However, it is possible to execute more finely tuned control by adding a number of categories in between the three to create numerous categories.

[0065]
As described above, it is possible to obtain print images under optimum conditions at all times by changing the control conditions of the printer according to the temperature and humidity.

[0066]
Consequently, the print output time can also be controlled to be minimized.

[0067]
Furthermore, since relates to the print output time, it is desirable that the control for the paper conveyance timing and the conveyance speed be changed also.

[0068]
In this manner, it is now possible to maximize the capability of the printer.

[0069] (Other Embodiments)

In the above embodiments, the structure was illustrated wherein the control set in the main body of the image forming device (printer) provides control that can deal with all environments, and with the attachment of an environment sensor (temperature-humidity sensor), it provides a level of control according to the environment under which the device is operated or the optimum control for the environment. In addition, it is possible to have a structure with additional controls where the user can select a mode so that, depending upon the mode selected, priority can be given to the

control to provide optimum conditions for each element according to the environment, or priority can be given to energy conservation or to prolonging the life expectancy of each part and the like.

[0070]
For example, if the mode giving priority to longevity is selected, then each component can be controlled in the following manner.

[0071]
In order to prolong the life of the printer main body as much as possible, the operation of the cooling fan is controlled.

[0072]
In addition, in order to prolong the life of electrical elements, power to the thermal fixing apparatus during the startup is held down as much as possible.

[0073]
The value limit for the electric current to the laser scanner motor is also held down as much as possible in order to prolong its life.

[0074]
Moreover, the life expectancy of the device is prolonged but not to the extent of compromising the performance of the printer under conditions of low temperature and low humidity.

[0075]
Furthermore, when printing is in progress continuously under high-temperature conditions, the life expectancy of the elements and the mechanical endurance of the members are prolonged by reducing the throughput.

[0076]
As described above, it is possible to dictate the operation of the printer main body to conserve energy, for optimization or to prolong its life expectancy through the use of the temperature-humidity sensor, which is optionally attached to the outer casing of the printer main body. Furthermore, the use of the temperature-humidity sensor can be further expanded by providing a structure wherein the user can select various modes.

[0077]
Advantages of the Invention

In the present invention, the device main body was provided with a mount for attaching an environmental sensor as required, thereby allowing changes to be made to the control for the prescribed drive on the basis of environmental information sent by the environmental sensor. Consequently, the environmental sensor needs to be attached only when the device is used in an environment requiring a change to be made to the control configured in the image forming device. As a result, the present invention makes it possible to provide an image forming device with a

simplified structure and having the ability to control the drive according to the environment under which it is used.

[0078]
Moreover, the installation of the environmental sensor makes it possible for the device to be operated while consuming the minimum electric power for the environment under which it is operated.

[0079]
Control that responds to the environment under which the device is operated is now possible because the environmental sensor sends to the main body of the device information based on temperature and humidity.

[0080]

The drive for each component of the device can be operated in a manner appropriate to the environment since changes can be made to the following controls on the basis of environmental information sent by the environmental sensor: value limit control for the electric current sent to the laser scanner motor; on/off control for the cooling device; the heating temperature control of the fixing device; transfer bias control; and developing bias control.

[0081]
If options for varied selections as to control details were to be provided when making changes to the control on the basis of environmental information sent by the environmental sensor, then this would allow for the control that is desired by the user.

[0082]
Regarding the mount for attaching the environmental sensor, the placement of a socket that matches the shape of the environmental sensor and a locking mechanism for locking in or unlocking it as required allows for it to be attached or detached readily.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG.1 is a sectional view showing a schematic construction of an image forming device according to an embodiment of the present invention.

FIG. 2 is a perspective view showing a schematic construction of an image forming device according to an embodiment of the present invention.

FIG. 3 is a diagram illustrating an example of a mount for an environmental sensor.

FIG. 4 is a flowchart for the control of the image forming device according to a first embodiment of the present invention.

FIG. 5 is a table showing variations in changes made to the control for an image forming device according to a second embodiment of the present invention.

Description of the Reference Numerals for the Drawings

1. Outer casing of a laser printer main body
2. Paper used
3. Paper feeder roller
4. Carrier roller
5. Laser scanner unit
6. [Tr.: missing in the original]
7. Transfer device
8. Thermal fixing heater
9. Pressure roller
10. Optional temperature-humidity sensor
11. Cooling fan

FIG. 1

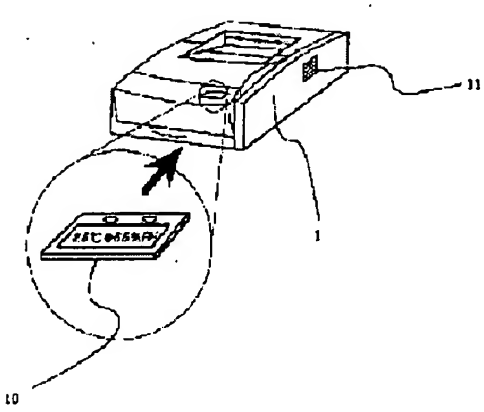


FIG. 2

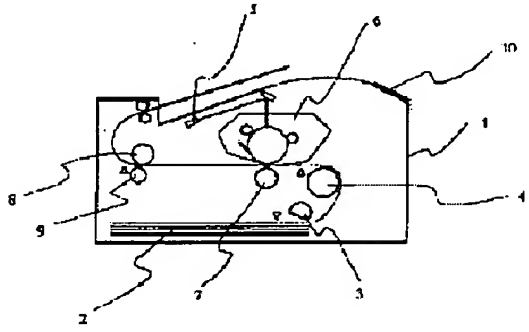


FIG. 3

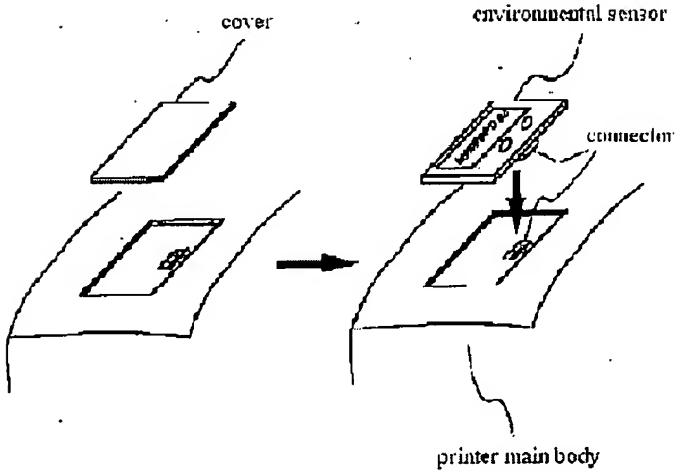


FIG. 4

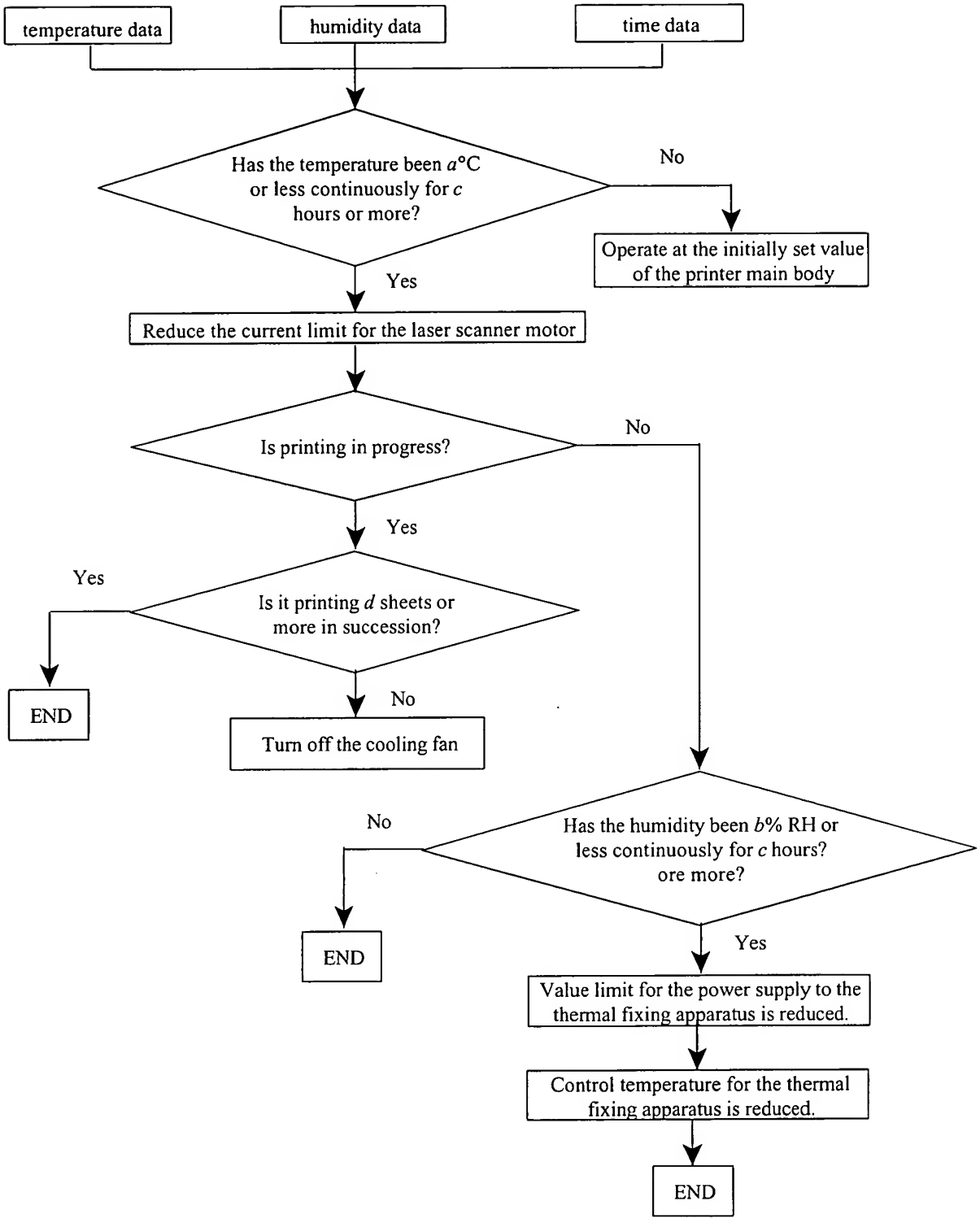

temperature data
humidity data
time data
Has the temperature been a°C or less continuously for c hours or more?
No
Operate at the initially set value of the printer main body
Yes
Reduce the current limit for the laser scanner motor
Is printing in progress?
No
Yes
Yes
Is it printing d sheets or more in succession?
END
No
Turn off the cooling fan
No
Has the humidity been b% RH or less continuously for c hours? ore more?
END
Yes
Value limit for the power supply to the thermal fixing apparatus is reduced.
Control temperature for the thermal fixing apparatus is reduced.
END

FIG. 5

Temperature/ Humidity	Transfer Bias	Developing Bias	Primary Charge Bias	Power to Fixing Apparatus at Startup	Current Limit Value to Laser Scanner Motor
High Temp./ High Humid.	Raised to the upper limit	Reduced to the lower limit	Raised to the upper limit	Raised to the lower limit	Reduced to the lower limit
...	...	...	...	...	...
...	...	...	...	...	...
...	...	...	...	...	...
Normal Temp./ Normal Humid.	Stipulated value	Stipulated value	Stipulated value	Stipulated value	Stipulated value
...	...	...	...	...	...
...	...	...	...	...	...
...	...	...	...	...	...
Low Temp./ Low Humid.	Reduced to the lower limit	Raised to the upper limit	Reduced to the lower limit	Reduced to the upper limit [sic?]	Raised to the upper limit